Introduction

1. We identified the volatile and discriminatory VOCs of explanted prosthesis sonicate fluid and cultures of PJI-causing strains grown in SSF.

2. VOC analysis of explanted prosthesis sonicate fluid can identify patients with PJI with 72.7% accuracy.

3. VOC analysis can discriminate between sterile and cultured synthetic synovial fluid.

4. VOC analysis of pathogens grown in synthetic synovial fluid can determine pathogen identity and antibiotic resistance of Staphylococcus aureus strains.

Background:
- Total joint replacements provide some of the greatest improvement in quality of life per dollar spent of any treatment [1].
- Knee and hip replacements together represent well over 90% of all joint replacements in the United States [2].
- Americans are living longer lives [3], so the number of hip and knee replacements will continue to rise.
- Knee and hip replacements significantly increase the susceptibility of these joints to infection, known as prosthetic joint infection (PJI).

Hypothesis: Volatilomic (volatile metabolomic) analysis can deliver a rapid, pathogen-specific diagnostic test for PJI. We believe such a diagnostic is feasible because of a fundamental multi-omics approach (below). First, I hypothesize that analysis of explanted joint fluid can determine if a joint has been infected within the current workflow of surgeries. Then I hypothesize that we can design a synovial-fluid based diagnostic for PJI that can allow PJI diagnosis before surgery.

Materials and Methods

Conclusions and Future Studies

VOC-based PJI diagnostics are:
- 72.7% accurate in identifying PJI.
- 76.7% accurate in distinguishing MRSA from MSSA.
- 83.3% accurate in distinguishing ESBL from MSSA.

Future Directions:
- Could examine the performance of a patient synovial fluid based diagnostic for PJI.
- Could expand the sample size to draw conclusions about pathogen identity from patient ex-vivo samples.
- Could investigate the value of an intermediate culture step.
- Could examine the performance of a patient synovial fluid based diagnostic for PJI.

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Bibliography:

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